

6.0 INGEST AND PRE-PROCESSING

Operation of the various satellite data processing systems is principally the responsibility of NOAA/NESDIS' Information Processing Division (IPD). Data are ingested into IPD's Central Environmental Satellite Computer System (CEMSCS) from the Satellite Operations and Control Center (SOCC) and from the Shared Processing Network (SPN). The CEMSCS has ingest and preprocessing systems for Polar, Geostationary and Shared Processing. The system described in this document is most relevant to the CEMSCS Polar Data Processing System (PDPS). The PDPS operation consists of components such as pre-launch activities, ingest, pre-processing, calibration, navigation, product generation and archive. Figure 6.0-1 shows the general flow of the polar data through the PDPS system.

NOAA's data levels are defined as follows:

Level 0 - Unprocessed telemetry data as received from the observing platform excluding communications artifacts introduced by the ground system.

Level 1a - Telemetry data that have been extracted but not decommutated from Level 0 and formatted into time-sequenced data sets for easier processing. The Level 1a formats are NOAA's internal formats and are only used for NOAA processing. They only exist briefly for the purpose of creating the Level 1b datasets.

Level 1b - Discrete, instrument-specific data sets derived from Level 1a containing unprocessed data at full resolution, time-referenced, and annotated with ancillary information including data quality indicators, calibration coefficients and georeferencing parameters.

The software systems that are implemented, operated and maintained, are in the following functional categories: Ingest (Level 1a), satellite dataset processing (Pre-Processing Level 1b), product processing, archiving, QC-monitoring, navigation and earth-location, data communications, calibration (pre- and post-launch) and Shared Processing.

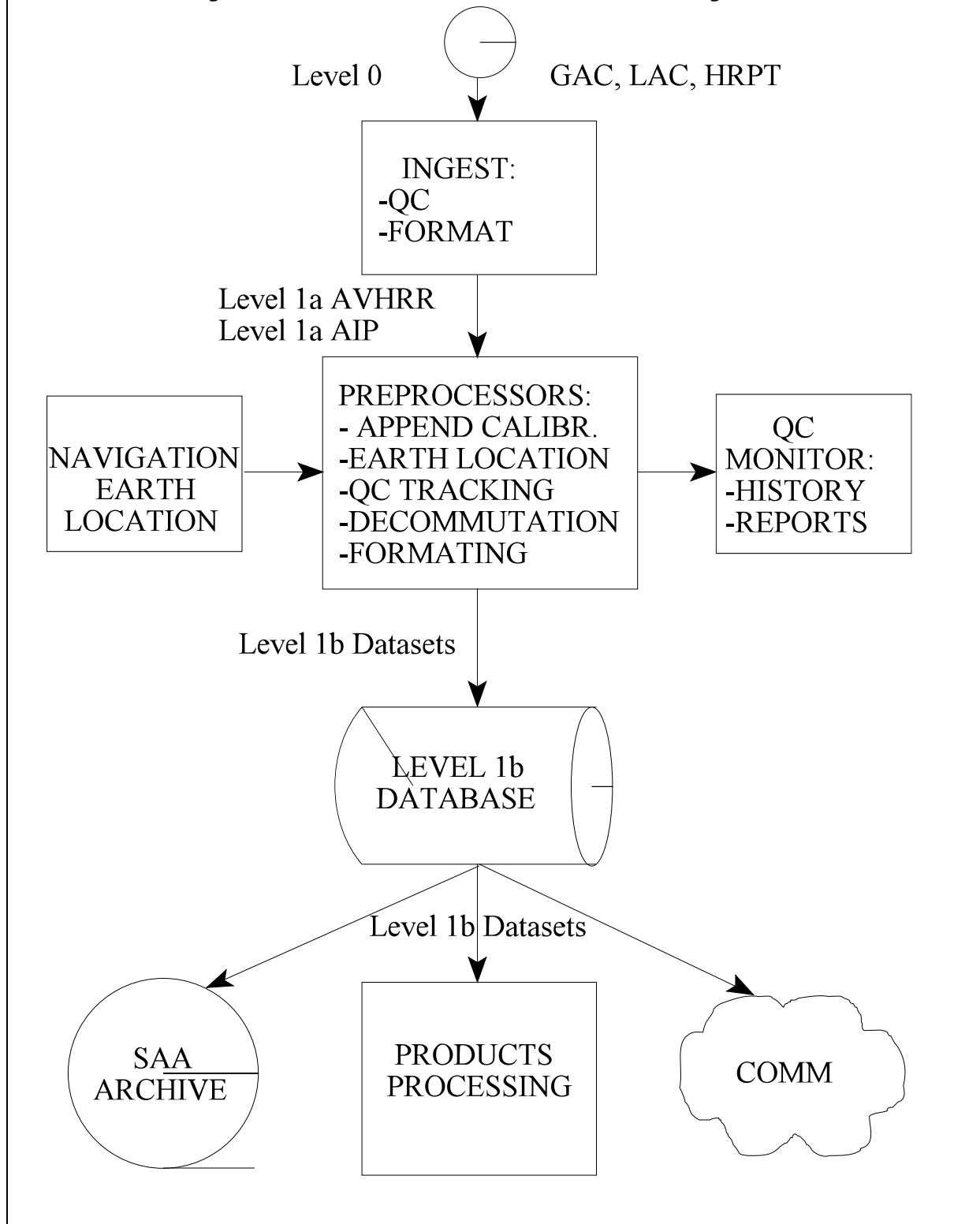
6.1 INGEST

Special purpose hardware/software is used to receive (ingest) data into the CEMSCS. This software includes polar satellite data, geostationary (GOES) satellite data, and Shared Processing data as received from, or transmitted between, the NESDIS and either the Air Force Global Weather Central (AFGWC) or the Navy Fleet Numerical Oceanographic Center (FNOC).

Basically, the ingestor accomplishes the function of transforming the satellite Level 0 to a more processing friendly Level 1a data set as follows:

1. Accepts and synchronizes frames of Level 0 satellite data.

Figure 6.0-1. Polar Data Processing Flow.



2. First level quality control of data stream, filling data gaps as necessary. Generation and forward of a data quality/status file.
3. Extracting AVHRR and AIP data from Level 0 data and formatting to a Level 1a. These two data sets are made available for the process of Level 1b transformation.
4. Generation of a unique data set name which includes an orbit number and time duration of the pass.

6.2 PRE-PROCESSING

Data pre-processing is a set of functions which combine to create the Level 1b databases. The software formats, error checks, calibrates, and appends earth locations and otherwise manages the ingested data. Raw spacecraft data are processed via Polar Acquisition and Control Subsystems (PACS) and made available to the Pre-Processing operation via the Ingest System as Level 1a data sets. The transformation of ingested data of Level 1a format into one or more data sets of Level 1b format primarily consists of the addition of instrument calibration coefficients and earth location information to the raw data stream. The transformation also provides supplemental data about the calibration process and thus indirectly about the instruments onboard the satellite. Data in the Level 1b format are made accessible for products, archival, file transfer and are used by the meteorological and climatological communities.

6.2.1 SYSTEM IMPROVEMENTS

The pre-NOAA KLM series of TIROS polar spacecraft have retained the same basic format of raw data streams for over 20 years. The new series of TIROS polar spacecraft (NOAA KLM) has new formats and somewhat larger volumes of data. The NOAA KLM Pre-Processing system processes both old and new spacecraft data. The software is modular and structured to allow platform independence. Program structures are designed to take advantage of modern operating systems with distributed processing providing faster availability of data products.

6.2.2 LEVEL 1b DATABASE IMPROVEMENTS

Enhancements have been made to the methods of access and storage of the Level 1b data. With the old system (pre-NOAA KLM), a change made in spacecraft or instrument configuration, would result in a change in the format of the encapsulation of the Level 1b data. When such a change was made in the up-front systems, the change had to ripple to the end user. A new Level 1b generating system (Level 1b*) provides a centralized database which contains the basic elements of the Level 1b and the associated supporting ancillary data. The database provides end-to-end accountability for data and data products to managers and users. The new system (Level 1b*) provides a universal access to the component elements of the dataset, thus providing transparency to the Level 1b format. Access to the Level 1b* database is facilitated by a library of utilities layered in a tree structure.

The facilities and services provided by the Level 1b* offers a means of simplifying and improving the interfaces of the Calibration Monitoring System. Specifically, these interfaces are between the Pre-processing input to the monitoring and monitoring output of status reporting to the users. The calibration process performed by the Pre-Processor passes resulting parameters to the offline monitoring system. The parameters transit an interface referred to as History Files. The Level 1b* database library has structures and utilities defined specifically to contain and access the information sent to the History File. This provides for a modifiable and maintainable system that is much more flexible than the old version.

6.3 CALIBRATION

Calibration and Data Monitoring consist of three software systems residing on the CEMSCS:

- Pre-launch calibrations,
- Online instrument data calibration and monitoring and
- Engineering evaluation.

6.3.1 PRE-LAUNCH CALIBRATION

The pre-launch calibration is the process which prepares the operational data pre-processing systems for new satellites and their instruments. This includes validation of instrument supplier's success in meeting instrument performance requirements. Each instrument manufacturer is required to supply parameters related to the characteristic performance of the instrument. Instrument Specifications are then validated with the accomplishment of: calculating the calibration accuracy; the instrument sensitivity; in-flight warm load; calibration correction factors; the calibration repeatability; and nonlinearity parameter for each channel. A report is generated which contains the plots of all thermal vacuum data derived quantities for each flight model, as well as a narrative description of how each quantity is computed.

6.3.2 ON LINE CALIBRATION

As part of normal operations, the data preprocessing software performs online instrument data calibration and monitors instrument telemetry to detect anomalies. When anomalies are detected, the data is flagged as suspect for the product systems.

6.3.3 CALIBRATION EVALUATION

Engineering evaluation is carried out as part of off-line support. The data calibration process is evaluated to provide evidence of instrument performance problems. This includes extracting selected data words, computing statistics and displaying/printing the information for analysis.

6.4 MONITORING AND QUALITY ASSURANCE

Monitoring software examines the real-time operation of the software system or performance of an instrument and generates operator error messages, statistics and reports. Comparison with appropriate "truth" data is also required in the monitoring system. Printouts and/or interactive data displays are examined for credibility.